Jun 27th, 2:10 PM - 2:30 PM

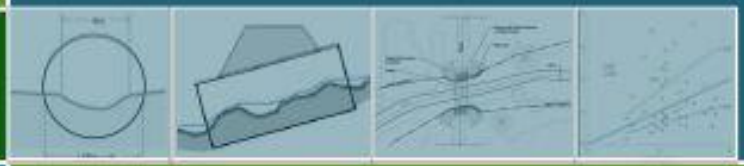
Concurrent Sessions D: Designing Roughened Channels for Fish Passage - Roughened Channel Design - The WDFW Perspective

Bruce Heiner
WDFW

Roughened Channels in Washington State

Bruce Heiner, P.E.

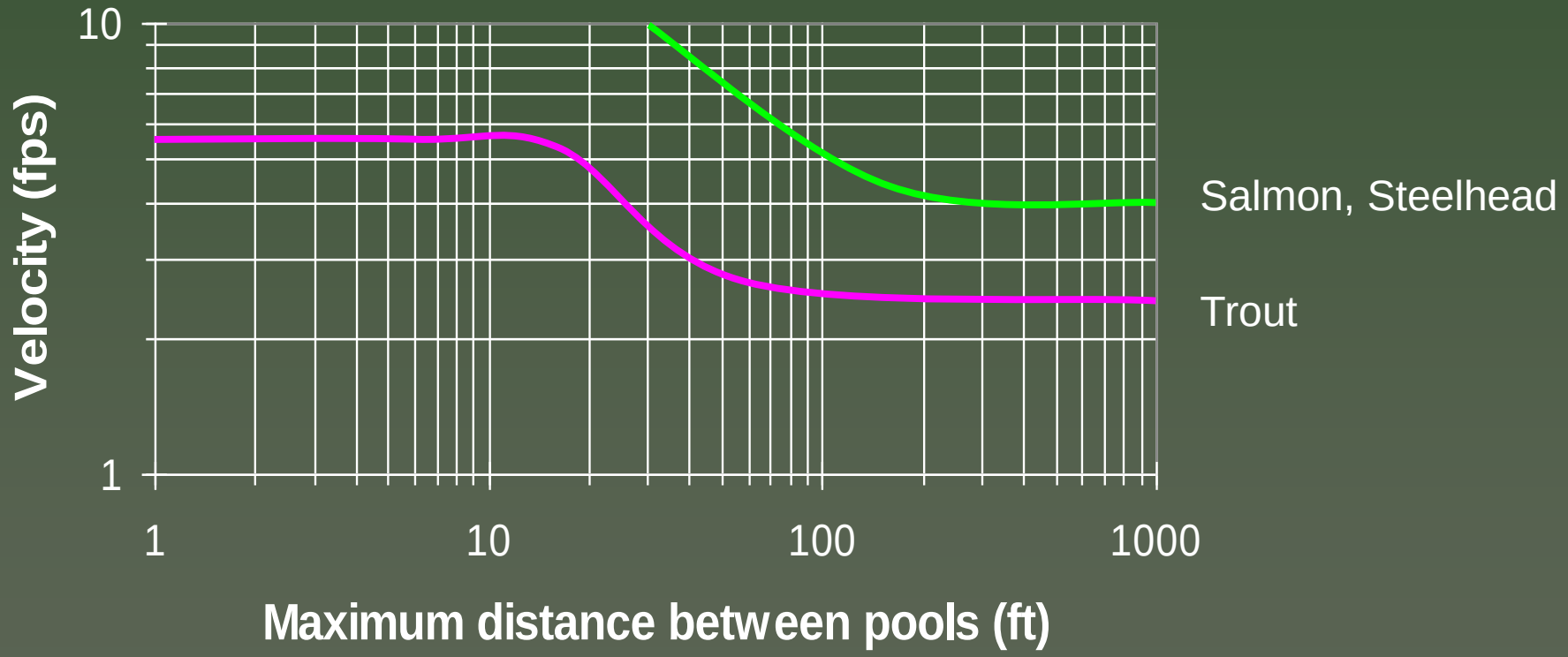
2013



Water Crossing Design Guidelines

Washington Dept. of Fish and Wildlife

Swimming Abilities of Salmon and Trout



From Evans and Johnston (1980), developed by Ziemer, ADFW

Stream Simulation Design

Stream Simulation Criteria

- Streambed width inside the culvert

  ≥ (1.2x BFW) + 2ft.

- Slope Ratio (culvert slope/channel slope)

  < 1.25

WDFW Water Crossing Guidelines

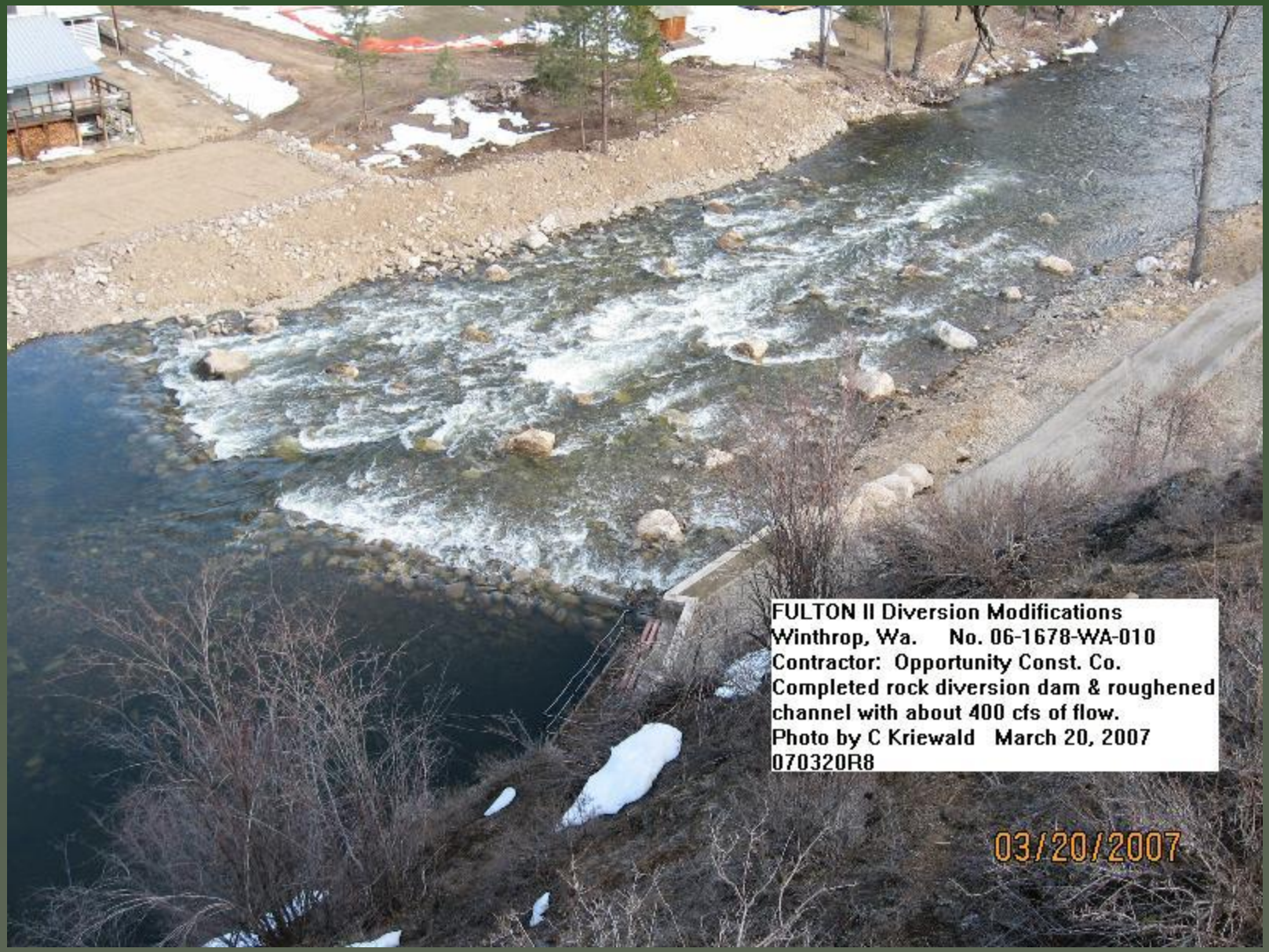
$200

WDFW Water Crossing Guidelines

A hydraulic design method to create a stable channel that has a slope ratio greater than 1.25 or a streambed width less than (1.2 x BFW) + 2 ft.


INGERSOLL-RAND
PRO-PAC SERIES
115


Coal Ck.
Roughened channel
Width ratio = 0.57
Slope = 5%


FULTON II Diversion Modifications
Winthrop, Wa. No. 06-1678-WA-010
Contractor: Opportunity Const. Co.
Completed rock diversion dam & roughened
channel with about 400 cfs of flow.
Photo by C Kriewald March 20, 2007
070320R8
03/20/2007

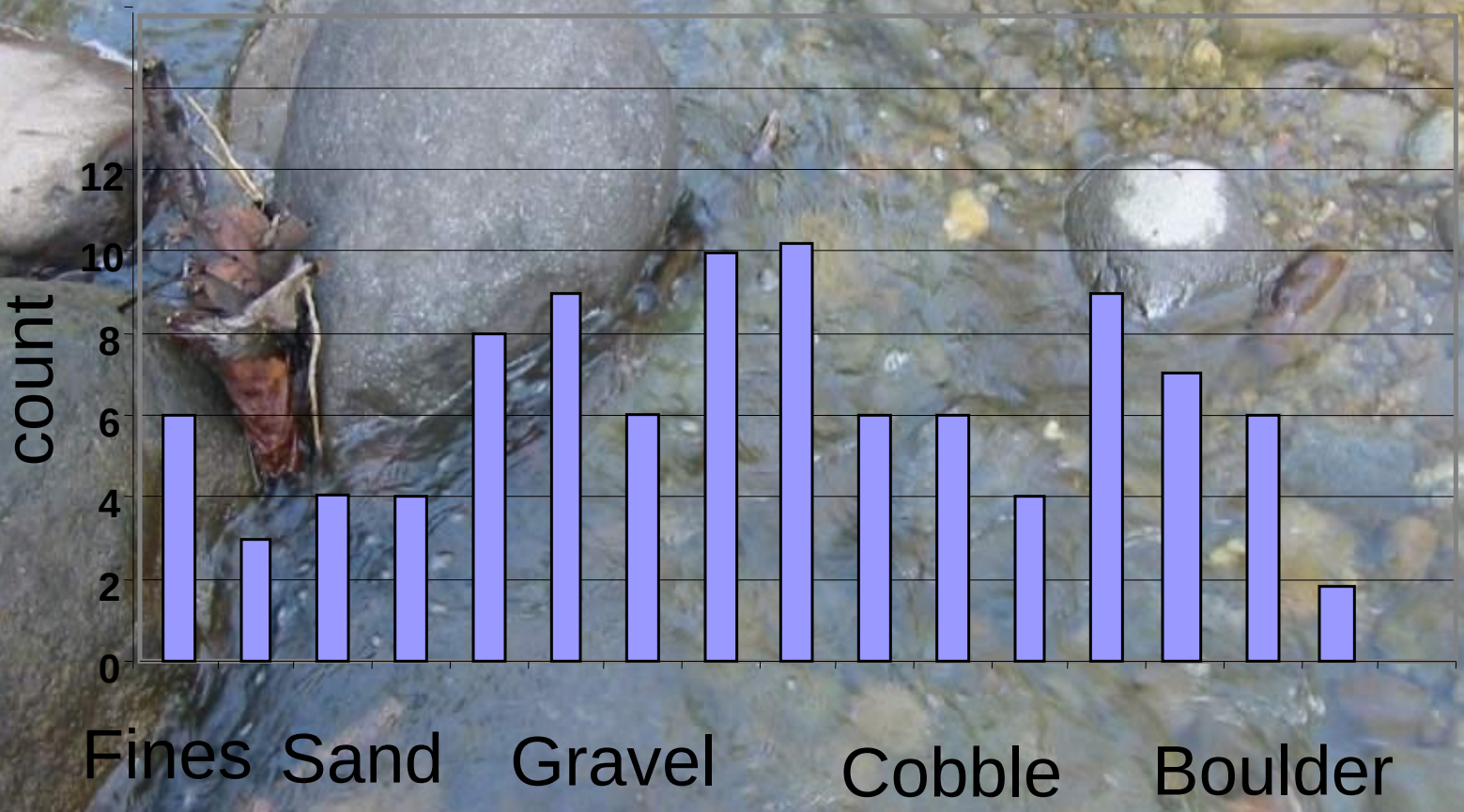
Roughened channel used for grade control below an existing culvert.

Dickerson Creek jacked pipe with baffles

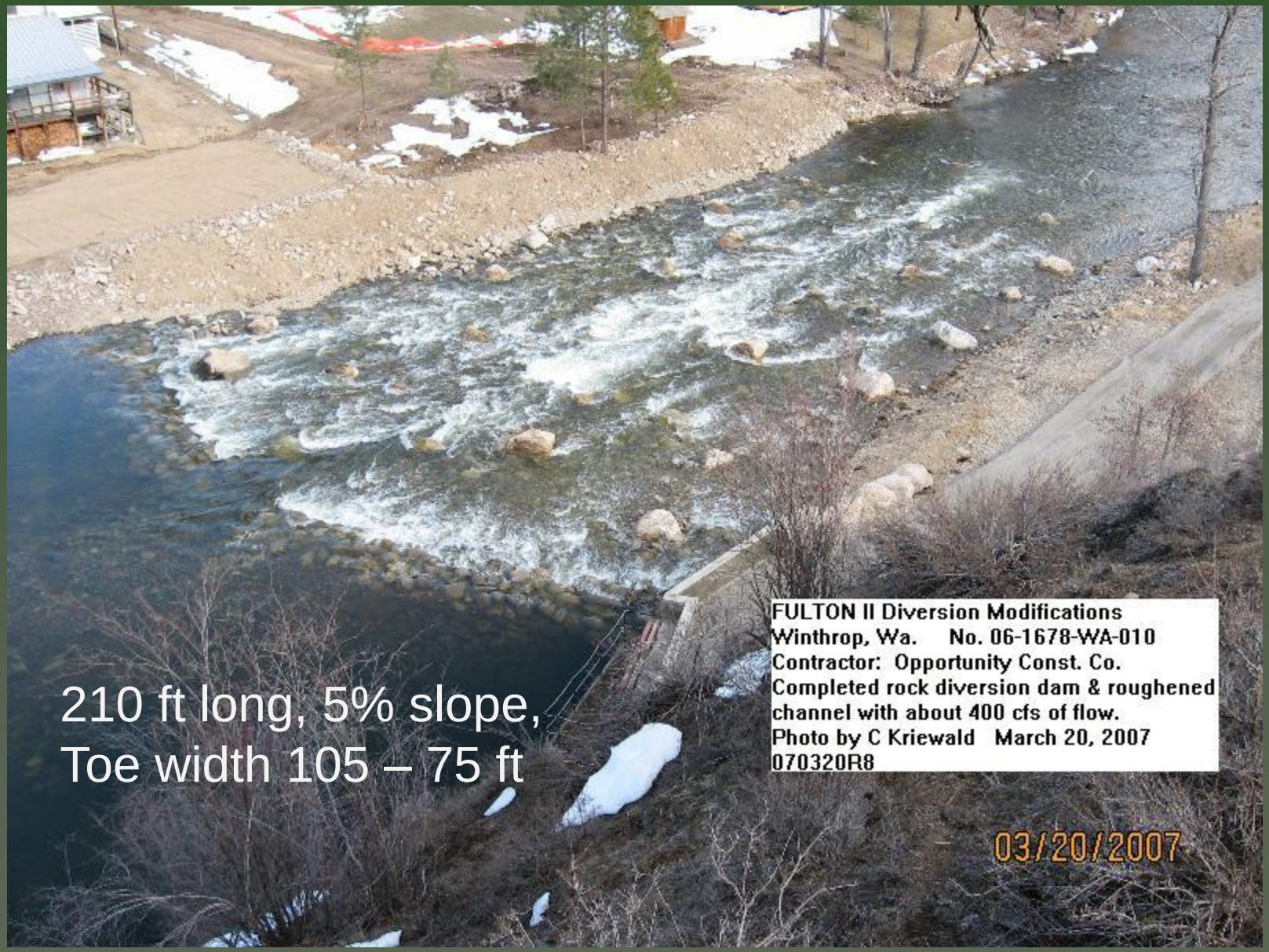
Roughened Channel Design Steps

1. Assume a channel span and shape.
2. Size bed material for stability at peak flow.
3. Check largest bed particle diameter is less than ¼ the channel span.
4. Create a bed gradation to control porosity.
5. Calculate average velocity and check turbulence at high fish passage flow.
6. Check culvert size for peak flood capacity.

Well-graded Bed Material



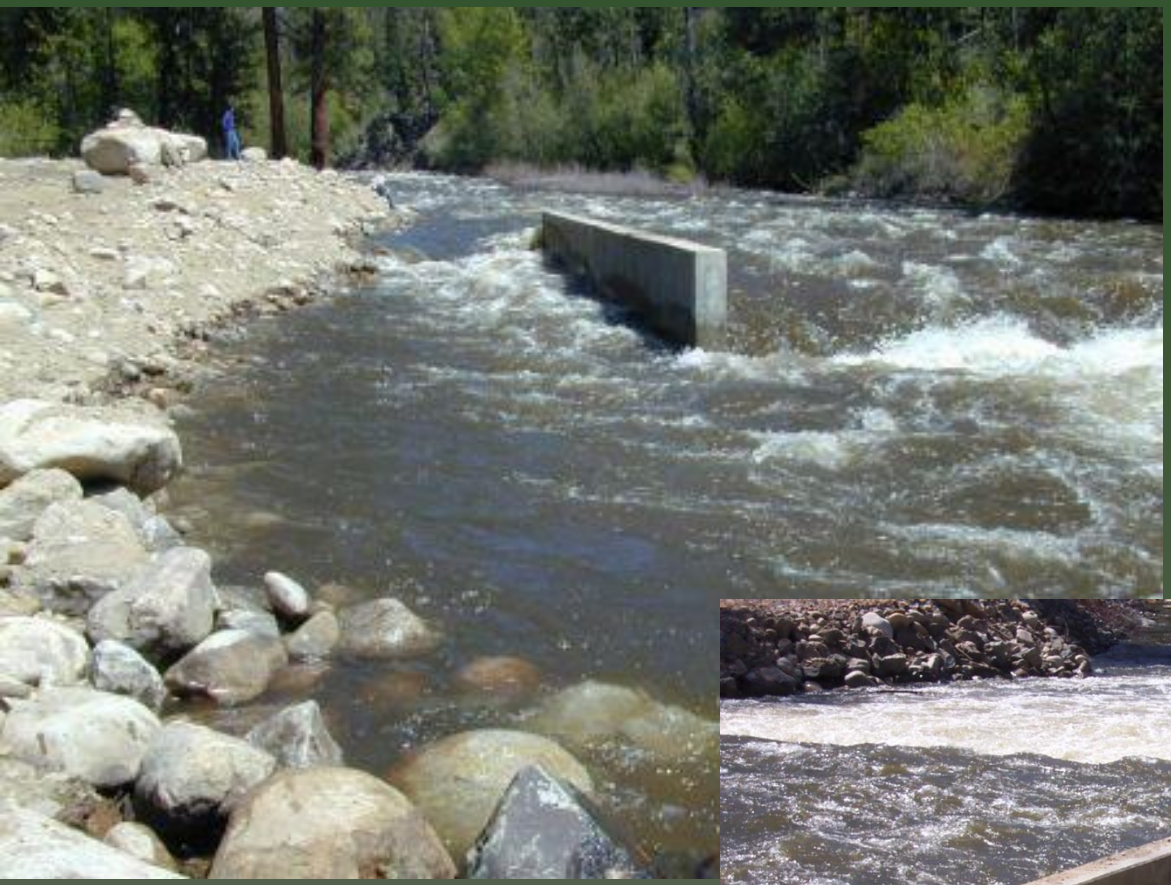
Fulton Irrigation Diversion, Chewuch River


210 ft long, 5% slope,
Toe width 105 – 75 ft
FULTON II Diversion Modifications
Winthrop, Wa. No. 06-1678-WA-010
Contractor: Opportunity Const. Co.
Completed rock diversion dam & roughened
channel with about 400 cfs of flow.
Photo by C Kriewald March 20, 2007
070320R8
03/20/2007

Chewuch River, Winthrop WA

New Chewuch diversion roughened channel

60 ft long, 6.3% slope, 10 ft toe width



2400 cfs

←

1650 cfs

→


5500 cfs

Curl Lake Acclimation Diversion Weir Tucannon River

60 ft long, 3.75% slope, 20 ft toe width

D100 = 4.5 ft.